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10/562178
IAP9 Rec'd PCT/PTO 22 DEC 2009

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26 April 2005

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Dear Sirs

International patent application No PCT/IB2004/002133
Applicant: Inter IKEA Systems B. V. et al
International classification: IPC 7 B26D3/14
My ref: 79288 TN/kp

The European Patent Office is hereby requested to carry out a detailed preliminary examination according to the enclosed DEMAND.

The official fee for the examination should be deducted from my account as per the enclosed fee calculation sheet.

Substitute pages 1-4 and 6-10 on which the preliminary examination is to be based are submitted. The substitute pages include an amended set of claims and relevant pages of the description adapted thereto. The amendments carried out also appear from the enclosed handwritten draft. No new subject matter has been introduced by the amendments carried out.

The new claim 1 corresponds to the old claims 1 and 2 in amalgamated form.

The new claims 2-5 correspond to the old claims 3-6.

The new claim 6 corresponds to the old claim 8.

The old claims 7 and 9 have been cancelled.

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The characterising features of the new claim 1 are:

a) – that the sector-shaped knife (9) extends over a per se known central angle v of approx. 225-300°

b) – and that the first knife end edge (9a) of the first knife portion (9a) is adapted to be turned from an initial position (5) – in which the knife end edge (9a) is positioned at a predetermined central angle x (the arc $\frac{\pi}{180} rx$) from radius to the cutting site (25) substantially corresponding to the desired slit length – and a central angle x forwards until a front edge slit (11) has been cut, said knife (9) being retarded when the knife gap (19) is positioned above the blank (3)

c) – and that the other knife end edge (9b) of the second knife portion (9b) – or an additional knife – is adapted, also by means of said slitting roller (7) said driving motor (21) and said programmer timer (23) to be turned from an initial angular position (y) and downwards into the cutting side (25) for the production of a rear edge slit (13), and subsequently be turned an arc substantially corresponding to the length (b) of the rear edge slit (13) of said blank, said second knife end edge (9b) being adapted to be retarded and then turned forwards in such a manner that the first knife end edge (9a) reaches its initial position (S) ready for slitting a subsequent packing blank (3).

As a result a great reliability is obtained, even at high speed; this is why the knife during operation is nearly balanced; the slots cut will present sharp edges. Further the machine is relatively inexpensive to produce. Thus a special technical advantage is obtained by the combination of the feature of the new claim 1.

The Examiner has cited:

D1 (WO 00/02715A) (cited as an Y publication) relating to an "Independently driven slotter unit". On pages 14 and 17 of this specification it is said that the slotting blades, i.e. knives can have an angular sweep of 220-320°, respectively 270°. For this reason I have inserted the words "a per se known central angle v " in the feature (a) of the new claim 1.

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D2 (US-A-4098173) (cited as an Y publication) relating to "An automatic compensating register". Since this citation was published in 1978 – i.e. 25 years before the priority date (27 June 2003) of the present application – I do not find it reasonable to combine such a publication with D1. The D2 publication is too old.

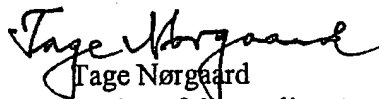
Actually one could argue: the fact that nobody for 25 years has got the idea of combining the knowledge of the two publications in question – such a combination not being done until 27 June 2003 by the inventor of the present application – really indicates that the invention possesses inventiveness.

Since the old claims 7 and 9 have been cancelled I shall not argue against the citations EP-A-1 120 209 and US 5546838A cited against these claims.

As to US 5699710A and GB 2302834A these publications were cited against the old claim 1; however as the latter forms the introductory part of the new claim 1 a sufficient limitation has been provided in relation to these publications.

Based on the above the Examining Division is hereby respectfully requested to accept the patentability of the present invention.

Yours faithfully
CHAS. HUDE A/S


Tage Nørgaard
Representative of the applicant

Encs

Title: Machine for slitting plane packaging blanks

Technical Field

- 5 The invention relates to a machine as indicated in the opening paragraph of claim 1.

Background Art

- 10 A packaging machine of this type is known which includes a driving roller assembly and slitting knives, but this machine does not operate completely satisfactorily because it is rather complicated and operates in a rather unreliable manner. In addition, this machine is rather expensive to manufacture.

- 15 WO 00/02715A relates to an independently driven slotter unit. It is mentioned that slotting blades may have an angular sweep of 220° - 320° , particularly 270° .

Disclosure of Invention

- 20 The object of the invention is to provide a machine of the above type which even at a high working speed is more reliable than hitherto known, and which in addition is inexpensive to manufacture.

The machine according to the invention is characterised in that the knife extends over a per se known central angle v of approx. $225-300^{\circ}$, the knife end edge of the first knife portion being adapted - by means of the slitting roller, the associated driving motor and the controlling programme timer - adapted to be turned from an initial position in which the knife end edge is positioned at a predetermined central angle x (the arc $\frac{\pi}{180} \cdot rx$) from radius to the cutting site substantially corresponding to the desired slit length - and a central angle x forwards until the front edge slit has been cut, and that said knife is retarded when the knife gap is positioned above the blank, and that the other knife end edge of said second knife portion or additional knife is adapted also by means of said slitting roller, said driving motor and said programme timer to be turned from an initial angular position y and downwards into the blank at the cutting site for the production of the rear edge slit and subsequently be turned an arc substantially corresponding to the length of the rear edge slit of said blank, where said second knife edge portion is retarded and then turned forwards in such a manner that the first knife end edge reaches its initial position ready to make slits in a subsequent packaging blank. As a result, a very high operational reliability is obtained even at a high working speed, and the slits present sharply cut edges. The machine is furthermore relatively inexpensive to manufacture.

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During the cutting of both the front edge slit and the rear edge slit, the knife may according to the invention be adapted to run at a peripheral speed which is substantially equal to the advancing speed of the packaging blank, by means of the slitting roller, the

driving motor and the programme timer. As a result a particularly high operational reliability is obtained.

Furthermore, according to the invention the knife may by means of the slitting roller,
5 the driving motor and the programme timer be adapted to ensure that during the re-
tarding movement the peripheral speed of said knife is finally zero. As a result the
machine operates intermittently with the result that energy is saved during the opera-
tion of said machine.

10 According to the invention the central angle x may be in the range $30^\circ < x < 70^\circ$,
and the angle y may be in the range $30^\circ < y < 70^\circ$, which corresponds to a knife gap
of more than 90° , especially 135° , said gap size turning out to be advantageous in
practice.

15 Moreover, the driving motor may according to the invention be a servomotor, such
as an electric step motor or a mechanical/hydraulic driving motor; this motor turned
out to be particularly advantageous in practice.

Finally according to the invention a back-pressure roller may be provided below the
20 slitting roller, said back-pressure roller for instance including two relatively thin cir-
cular disks interspaced a distance corresponding to the thickness of the knife. The re-
sulting edges cut in the front edge slit and the rear edge slit, respectively, are very
sharp.

Brief Description of the Drawings

The invention is explained in detail below with reference to the drawings, in which

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Fig. 1 is a diagrammatic view of an embodiment of a portion of the machine according to the invention,

Fig. 2 is a perspective view of the embodiment of Fig. 1, where the first knife edge
10 of the knife is in its initial position and is ready to cut a front edge slit in a packaging blank,

Fig. 3 corresponds to Fig. 2, but here the front edge slit of the blank has been cut and the gap of the knife is positioned above said blank,

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Fig. 4 corresponds to Fig. 3, but here the cutting of the rear edge slit of the blank has been completed, and

Fig. 5 is a perspective view of a blank provided with a front edge slit and a rear edge
20 slit.

Best Mode for Carrying out the Invention

The machine shown in Fig. 1 is suited for slitting plane packaging blanks, especially
25 packaging blanks made of corrugated board, but it can also be used for blanks made of cardboard. The machine includes a driving roller assembly 1 for advancing aligned packaging blanks 3 in the direction A through the machine. The driving roller assembly includes several sets of shafts 1'a, 1'b, 1''a and 1''b. Cylindrical friction members 5 are placed on these shafts and co-operate in pairs, such as 5' and 5''.
30 These friction members are preferably made of plastics or rubber.

In addition, the machine includes at least one rotatable slitting roller 7, which is provided with at least one knife 9 for cutting a front edge slit 11 or a rear edge slit 13 in the blank, cf. the blank 3 shown in Fig. 5.

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The slitting knife 9 is circular and defined by two knife edges 9a and 9b. The first knife edge 9a is arranged at a first knife portion 9A, and the second knife edge 9b is arranged at a second knife portion 9B. The knife extends across a central angle v of max. 300° with the result that the knife presents a knife gap 19 between the knife
10 edges 9a and 9b of at least 60° .

The slitting roller 7 is connected to a driving motor 21 controlled by a programme timer 23, cf. Fig. 1. When a front edge slit 11 is to be produced in the blank 3 where the front edge 15 of the blank has reached the cutting site 25 of the knife, cf. Fig. 2,
15 this programme timer is adapted to turn the knife 9 in such a manner that the first knife edge 9a can be turned forwards from an initial position B in which position the knife edge 9a is positioned at a predetermined central angle x (the arc $\frac{\pi}{180} \cdot rx$, where r is the radius of the knife) from radius to the cutting site 25 substantially corresponding to the desired slit length f , cf. Fig. 5, and a central angle x forwards until
20 the front edge slit 11 has been cut, whereafter the programme timer 23 ensures that said knife is retarded when the knife gap 19 is positioned above the blank 3, cf. Fig. 3. During this procedure, the blank 3 is still forced forwards by the driving roller assembly 1'a, 1'b, 5', 5'', cf. Fig. 1, i.e. even when the knife does not engage the blank. In connection with the cutting of the rear edge slit 13 in the blank 3, cf. Fig. 5, the
25 programme timer 23 is adapted to turn the second knife edge 9b on the knife portion 9B or on an additional knife not shown out of an initial position y and downwards onto the cutting site 25 and subsequently to turn said knife edge a segment, cf. Fig. 4, corresponding to the length b of the rear edge slit 13 of the blank, cf. Fig. 5. Then the programme timer is adapted to retard the knife and subsequently turn said knife
30 forwards in such a manner that the first knife edge 9a reaches its initial position B,

cf. Fig. 2, in which the knife 9 is ready to receive a subsequent blank 3.

It is possible to provide the blank 3 with either a front edge slit 11 or a rear edge slit 13 or both slits in one and the same working operation while said blank 3 passes the
 5 slitting knife 9. The front edge slit 11 is cut from the front edge 15 of the blank 3 and into said blank, whereas the cutting of the rear edge slit 17 is initiated at a distance from the rear edge of said blank and continued in a rearward direction through the rear edge 17.

10 During the cutting of both the front edge slit and the rear edge slit, the knife 9 is adapted to run at a peripheral speed which is equal to the advancing speed of the packaging blank 3 by means of the slitting roller, the driving motor and the programme timer. However, nothing prevents the peripheral speed from exceeding the advancing speed of the blank 3 at predetermined moments.

15 The slitting roller 7, the driving motor 21 and the programme timer 23 allow the knife 9 to be adapted to ensure that during the retarding movement the peripheral speed of said knife is finally zero.

20 The knife 9 can also extend across a central angle v of max. 270° , especially 225° , whereas the angle x can be in the range $30^\circ < x < 70^\circ$ and the angle y can be in the range $30^\circ < y < 70^\circ$.

The driving motor 21 can be a servomotor, such as an electric step motor or a me-
 25 chanical/hydraulic driving motor. It is important that the driving motor can react sufficiently quickly to the command signals of the programme timer 23.

At least one sensor device 27 can be mounted before the slitting roller 7 when seen in the advancing direction A of the packaging blanks 3. This sensor device 27 is
 30 adapted to detect the entering blanks 3, and it can for instance be an optical sensor and adapted to transmit an activating signal to the programme timer when a blank 3

passes by. In this manner the first knife edge 9a of the knife 9 can be caused to quickly enter its initial position B when said blank 3 reaches the knife 9.

5 As illustrated in the Figs. 1 to 4, a back-pressure roller 8 can be provided below the slitting roller 7. This back-pressure roller 8 is for instance provided with two relatively thin, circular disks 8a, 8b interspaced a distance corresponding to the thickness of the knife. These circular disks are suited for making the edges of the front edge slit 11 and the rear edge slit 13 particularly sharp.

10 It should be noted that the knife 9 indicated in the Figs. 2 to 4 is rather large; the knife edge is not clearly shown, but such a knife edge is, of course, provided in practice.

15 The back-pressure roller 8 arranged below the slitting roller 7 can be provided with a resilient coating, preferably made of rubber.

Furthermore it should be noted that the knife 9 rotates clockwise during the cutting of both the front edge slit and the rear edge slit, and that the direction of rotation is also clockwise from the moment the rear edge slit has been cut to the moment the first knife end edge is in the initial position B. However, it is possible to turn the knife 9 during the latter procedure so as to rotate counterclockwise in order to cause the first knife end edge to enter the initial position B.

Claims

1. A machine for slitting plane packaging blanks (3), especially packaging blanks made of corrugated board, said machine being of the type including a driving roller assembly (1'a, 1'b, 5', 5'') for advancing said packaging blanks, as well as at least one rotatable slitting roller (7) with at least one knife (9) for producing a front edge slit (11) and/or a rear edge slit (13) in each packaging blank, said knife (9) being sector-shaped, and defined by two knife end edges (9a, 9b), a first knife portion (9A) adjacent the first knife end edge (9a) being adapted to cut the front edge slit (11) out in the front edge (15) of said blank (3), whereas a second knife portion (9B) adjacent the other knife end edge (9b) being adapted to cut a rear edge slit (13) out in the rear edge (17) of said blank (3) and rearwards through said rear edge (17) while said blank (3) is advanced through the machine at a uniform speed, characterised in, that the sector-shaped knife (9) extends over a per se known central angle v of approx $225-300^{\circ}$, and that the knife end edge (9a) of the first knife portion (9A) by means of the slitting roller (7), the driving motor (21) and the programme timer (23) is adapted to be turned from an initial position (S) - in which the knife end edge (9a) is positioned at a predetermined central angle x (the arc $\frac{\pi}{180} \cdot rx$) from radius to the cutting site (25) substantially corresponding to the desired slit length - and a central angle x forwards until the front edge slit (11) has been cut, and that said knife (9) is retarded when the knife gap (19) is positioned above the blank (3), and that the other knife end edge (9b) of said second knife portion (9B) or an additional knife is adapted also by means of said slitting roller (7), said driving motor (21) and said programme timer (23) to be turned from an initial angular position (y) and down-

wards into the blank at the cutting site (25) for the production of the rear edge slit (13), and subsequently be turned (9) an arc substantially corresponding to the length (b) of the rear edge slit (13) of said blank, where said second knife edge is retarded and then turned forwards in such a manner that the first knife end edge (9a) reaches
 5 its initial position (S) ready to make slits in a subsequent packaging blank (3).

2. A machine as claimed in claim 1, **characterised in** that by means of the slitting roller (7), the driving motor (21) and the programme timer (23), the knife (9) is adapted during the cutting of both the front edge slit (11) and the rear edge slit (13)
 10 to run at a peripheral speed which is substantially equal to the advancing speed of the packaging blank (3).

3. A machine as claimed in claim 1 or 2, **characterised in** that by means of the slitting roller (7), the driving motor (21) and the programme timer (23), the knife (9)
 15 is adapted to ensure that during the retarding movement the peripheral speed of said knife (9) is finally zero.

4. A machine as claimed in claims 1, 2 or 3, **characterised in** that the central angle x is in the range $30^\circ < x < 70^\circ$, and the angle y is in the range $30^\circ < y < 70^\circ$.
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5. A machine as claimed in one or more of the claims 1 to 4, **characterised in** that the driving motor (21) is a servomotor, such as an electric step motor, or a mechanical/hydraulic driving motor.

6. A machine as claimed in one or more of the claims 1 to 5, **characterised in** that a back-pressure roller (30) is provided below the slitting roller (7), said back-pressure roller (30) for instance including two relatively thin, circular disks interspaced a distance corresponding to the thickness of the knife (9).